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# (12) UK Patent Application (19) GB (11) 2 223 132 (13) A

(43) Date of A publication 28.03.1990

(21) Application No 8813583.5

(22) Date of filing 08.06.1988

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(51) INT CL<sup>4</sup>  
H01R 13/00 4/24 13/502 13/585

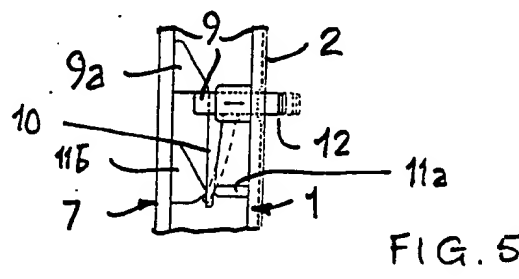
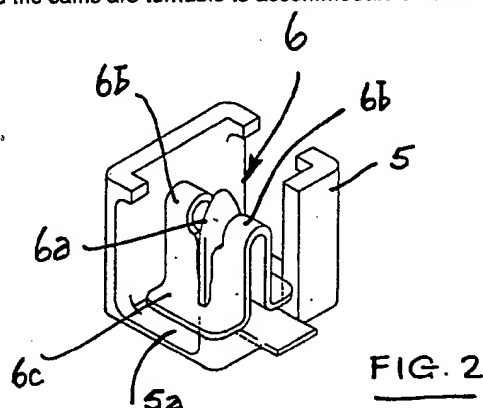
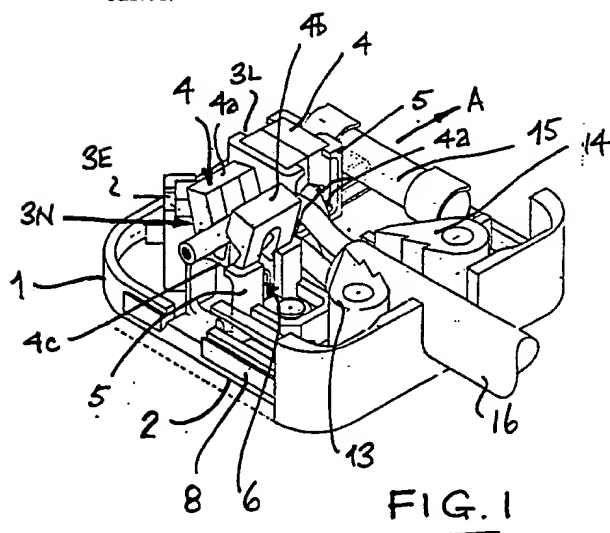
(52) UK CL (Edition J)  
H2E EDCK EDLC EGAU3 EGGD EPAA EPGP EPSA  
EPSV E140 E290 E535 E552 E600 E609 E725

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GB 2039426 A GB 1559789 A GB 1464608 A  
US 4298238 A

(58) Field of search  
UK CL (Edition J) H2E  
INT CL<sup>4</sup> H01R

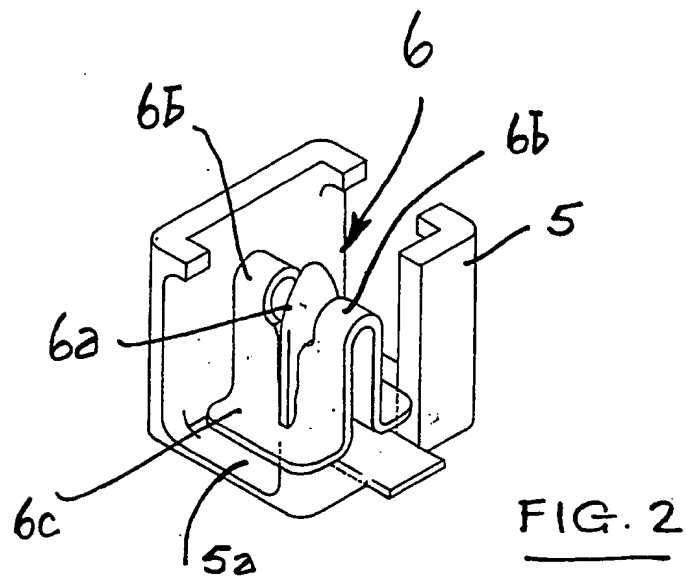
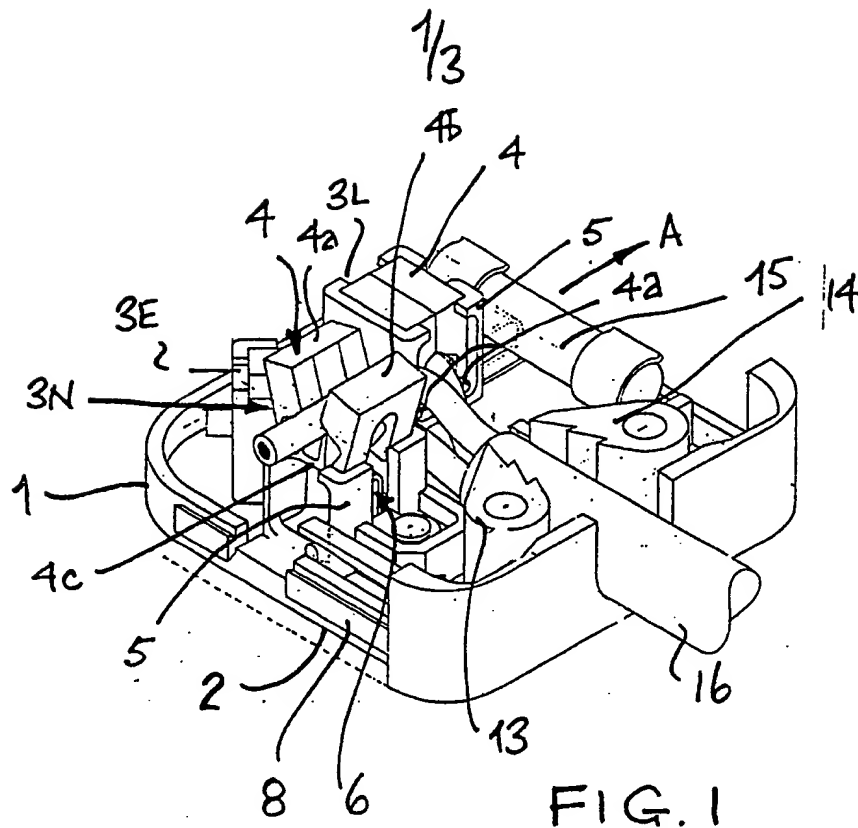
## (54) Improved rewirable plug

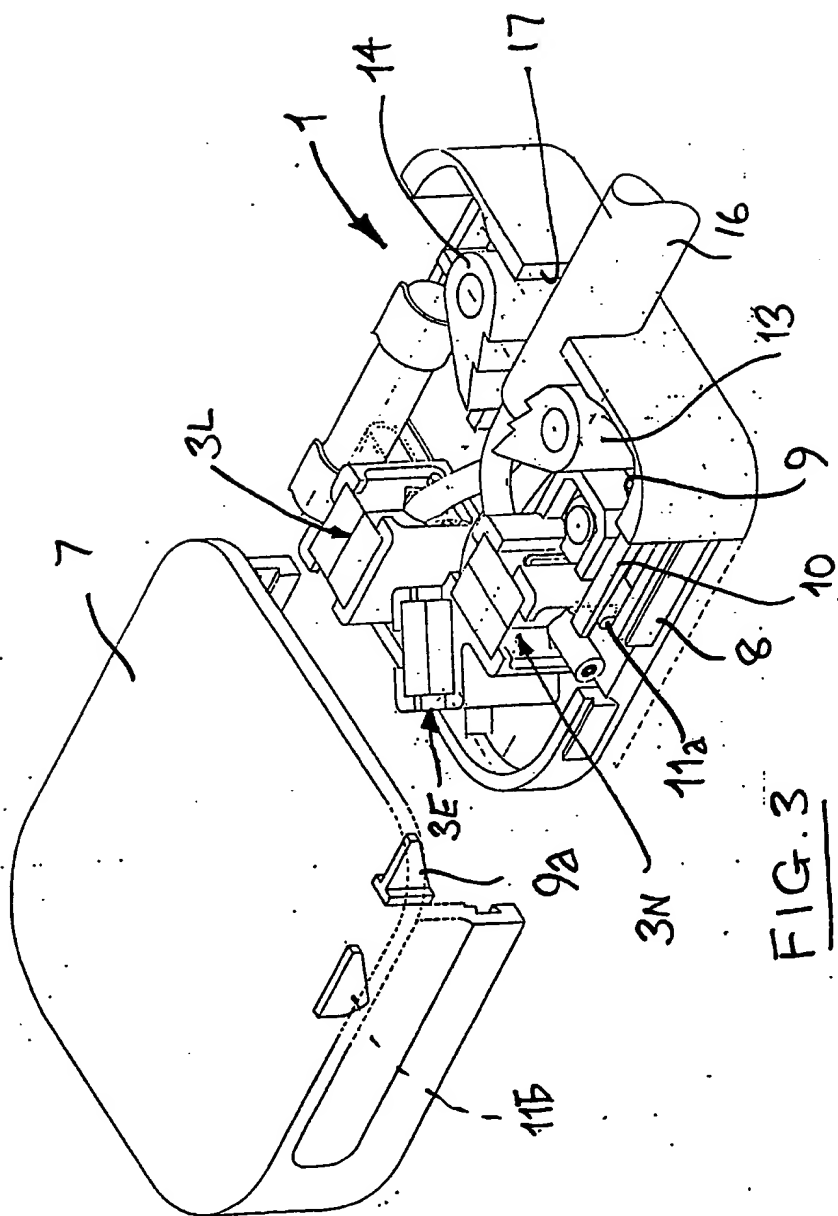
(57) A rewirable plug having a plug base (1) and a removable lid, has unsheathed but unstripped wires of an electrical cord (16) trapped in respective piercing terminals (3N, 3E, 3L) where electrical contact between the conductor strands of the wire core and plug pin (not shown) is achieved. Each terminal includes a colour-coded wire-receiving cradle (4) captive in a recess (5) but movable therein relative to a wire-insulation piercing blade (6a) and at least one insulation displacement slotted plate (6c) which acts to clamp the wire strands to the blade. The lid slides on the base (1) via dovetails (8) and is locked closed by a locking pin (9) which is non-releasable when the plug is in use. The pin (9) is spring-urged to a lid-retaining position after sliding via a lid cam (9a), and is released by a manually gripped post (not shown) or pin end (12). A cooperating socket masks the pin end to prevent access and/or movement needs for lid release. A grip based on opposed turnable toothed cams 13, 14 is provided for the cord 16, and the cams are turnable to accommodate differently-sized cables.

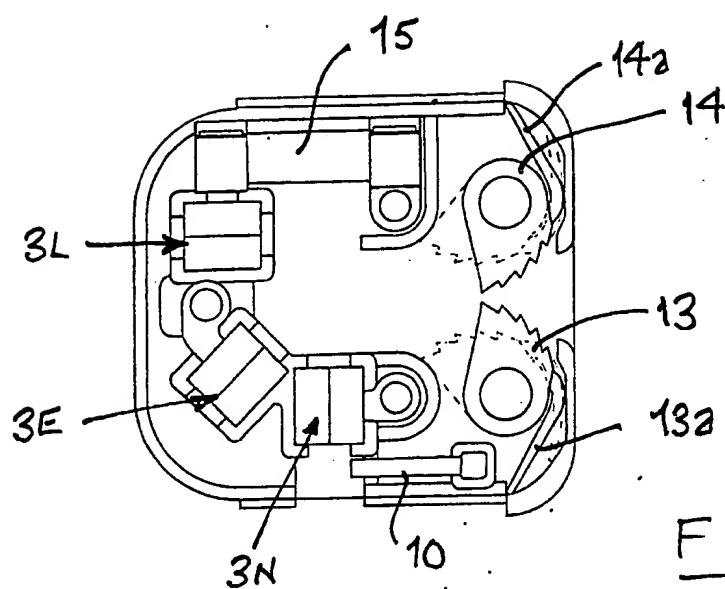
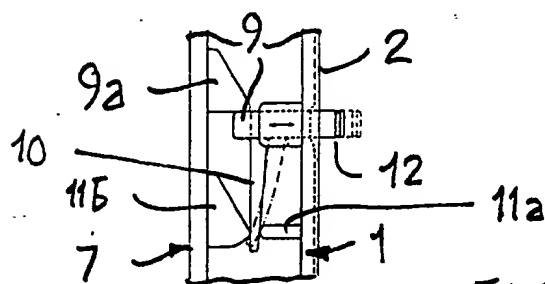


The claims were filed later than the filing date within the period prescribed by Rule 25(1) of the Patents Rules 1982.

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FIG. 4FIG. 5

IMPROVED REWIRABLE PLUG

This invention relates to an improved rewirable plug (e.g. a fused 13 amp 3-pin plug in accordance with BS 1363) in which (a) electrical connection of the wire ends to plug pins, (b) securement of a removable plug lid over a plug base supporting the pins to enclose the wire ends, and (c) clamping of the cord sourcing the wire ends to the plug, are all effected without the need for any tools, provided a short length of the outer sheath of the cord has been removed to allow the separation of the electrically insulated wire ends.

Various attempts have been made to evolve designs to separately meet each of the requirements (a), (b) and (c) set out above. Thus, for example, tool-less electrical connection of wire ends to plug pins without stripping the electrical insulation off the conducting core of the wire ends is proposed with the constructions shown in my British Patents 1559789 and 2130816.

Tool-less securement of a removable plug lid over a plug base is described in my US patent 4298238.

Tool-less clamping of an electrical cord to the plug base is widely practised and one design suitable for a rewirable plug is that shown in my prior British Patent 2039426.

This invention relates to a novel combination of the known features which is expected to give both cost and use advantages over other known combinations of features.

According to the present invention, a rewirable plug comprising a plug base with a plurality of straight, parallel, electrically-conducting pins projecting from a face of the plug base, the base cooperating with a removable lid to define a plug body and create a volume in which a

piercing terminal terminating each respective pin is  
 located, the plug body including an access opening through  
 which a pluri-wire electrical cord enters the said volume  
 and a cord grip adjacent to said opening to engage said  
 5 cord and resist its removal from the plug body by cord-  
 applied tension, is characterised in that

a) each piercing terminal takes the form of a wire-  
 receiving cradle having a pair of plates turnably connected  
 together via a channel member, said cradle being captive in  
 10 a terminal recess and movable therein in the axial  
 direction of the pin between an open condition in which a  
 wire end can be located between the cradle plates and a  
 closed position in which a conducting blade and at least  
 one associated insulation displacement (ID) plate are  
 15 located between cradle-supported regions of the wire end  
 and pass through said channel member, in that

b) the lid slides on the base in a direction normal to  
 the axes of the pins towards the access opening until  
 interengaging releasable locking means on the lid and base  
 20 coact to close the plug body, said locking means being  
 rendered non-releasable when the plug is properly inserted  
 into a socket by means projecting through the face, and in  
 that

c) the cord grip comprises an opposed pair of cams  
 25 each turnably mounted in the volume and each linked to an  
 integral spring means, the confronting faces of the cams  
 each exhibiting a series of teeth, the spacing between  
 opposed teeth on the two confronting faces varying as each  
 cam is turned to vary the energy stored in the spring  
 30 means.

Suitably the conducting blade is flanked by two arch-  
 shaped ID plates, the span of each arch being less than the  
 width of the blade.

Desirably there are three pins in the arrangement  
 35 dictated by BS 1363 and one of the current-carrying pins is  
 linked to its respective piercing terminal by a cartridge

fuse carrier. The fuse can be insertabl into its carrier in a dir ction parall l to th fac of the plug base when the lid is removed from the base.

One embodiment of plug in accordance with this  
5 invention will now be described, by way of example, with reference to the accompanying drawings, in which:

Figure 1 is an isometric view of the base of the plug showing two wire ends of a cord properly connected and one in the process of being connected,

10 Figure 2 is an enlarged, partially-broken away isometric view of one of the piercing terminals showing the blade and two surrounding ID plates,

Figure 3 shows the plug base with lid in position to slide over the base into its locked position,

15 Figure 4 shows the working of the cord grip in the base, and

Figure 5 shows a detail of one form of arrangement used to render the locking means non-releasable during use of the plug.

20 The plug illustrated comprises a plug base 1 having conventional earth-, line- and neutral-pins (not shown) projecting from a face 2 of the base. Each pin is associated with its respective piercing terminal arrangement (indicated by the reference numeral 3E, 3L and 3N)  
25 which comprises a plastics cradle 4, a terminal recess or box 5 (in which the cradle is captive via pegs 4a) and a wire-end piercing arrangement 6. Each cradle 4 comprises two plates 4a, 4b hing d together on either side of a chann l member 4c.

30 The piercing arrangement 6 (see Figur 2) shows an L-



shaped conducting blade 6a one arm of which is disposed between a pair of arch-shaped ID plates 6b. The plates 6b are formed from a single piece of electrically conducting metal which piece is mounted via feet 6c which sit partly on the floor 5a of the terminal box 5 and partly on the other arm of the blade 6a. The span of each arch is less than the width of the blade 6a so that the bundle of conductor strands located inside the electrical insulation of the respective wire end is split by the blade and is clamped at each of two locations, an arch span apart, to the two sides of the blade 6a by a pair of opposing ID plate edges.

The pair of ID plates illustrated have been designed to keep the insulation displacement force low by adopting the minimum thickness for the ID plates compatible with the structural strength needs of the ID plates and also by staggering the leading edges of the two pairs of opposite edges to desynchronise the peak entry forces of the two pairs.

The action of the terminal piercing arrangement starts with a wire end loaded into the plastic cradle 4 sitting in an open position at the top of its terminal box 5 rising up from the floor of the plug base. The cradle and its wire end are then pressed down into the terminal box during which the conductor is first pierced by the blade 6a and then clamped by the ID plates 6b at either side of the blade. The non-detachable cradles are all colour coded to match the colours of the conductor wire ends.

The plug body is completed by sliding a lid 7 onto the base 1 from the Earth pin end to the cord grip end of the base 1.

The connecting slide is a dovetail 8 protruding out low down on the base 1 on each side.

A special distinguishing feature of a plug in accordance with this invention is the locking means used to lock the lid 7 to the base 1. The lid 7 automatically locks on the base 1 in the process of being slid into its closed position. A plunger 9 (see Figure 5) is slidably mounted in the base 1 and is depressed 2 mm by a ramp 9a on the underside of the lid 7. When the lid 7 is in its fully closed position, the plunger 9 shoots back into its neutral position to lie behind the ramp 9a and lock the lid closed. In this neutral position the plunger 9 protrudes sufficiently beyond the face 2 (e.g. some 3 mm) to allow the protruding portion 12 to be gripped and pulled out to release the lid 7. The protruding portion of the plunger 9 is pushed into the base when the plug is inserted into a socket and thereby further strengthens the locking of the lid in its fully closed position. The plunger 9 is sprung in both directions, in and out, by a single plastic lever 10 integral with the plunger, the far end of which lever is held between a fulcrum 11a on the floor of the base and a fulcrum 11b which descends from the underside of the lid 7.

An alternative design of locking arrangement is possible in which, as before, the lid 7 slides on the base 1 from the Earth pin end towards the cord grip end. The Earth pin end wall is again on the lid 7 as are the two side walls. The wall at the cord grip end is on the base 1. The connecting slide is again a dovetail protruding out low down on the base on each side.

The plunger used in the alternative design is similar to that illustrated and described above except that the unlocking of the lid is performed by pushing a small button projecting out from the side of the plunger towards the viewer, sliding in a slot left between the dovetail edge of the cover and the facing edge of the corner of the end wall of the base and not by pulling on a plunger 12 protruding from the face 2. In the alternative design,

the plug rods do not normally protrude below the pin face 2, but as the lid 7 is moving towards its closed position on the base 1 and the button is pushed in it does so protrude temporarily. A very similar spring arm arrangement (e.g. like the arm 10 in Figure 5) is used in the alternative design. Because the button normally lies flush with the pin face 2, and only projects from the pin face 2 of the base 1 as the lid is being locked or unlocked, the lid 7 cannot be unlocked from the base 1 whilst the plug is in a socket.

The cord grip is an important safety element in any mains plug. My new cord grip has two pivoted cams 13, 14, one, on either side of the cord 16. The cams are spring loaded to press the teeth of the cams onto opposing sides of the cord close to where it passes through the access opening 17. The spring pressure is provided on each cam by a spring lever 13a, 14a integral with the cam itself and pressing on the end wall of the base. The purchase of the cams is provided by a slight outward movement of the cord which makes each cam bite into the cord.

The terminal arrangement 3L is connected to its plug pin via a fuse 15 which is removed sideways as shown by the arrow A in Figure 1.

The cord grip allows cords of different diameters to be securely gripped against removal by cord-applied tension. Figure 4 shows the position of the cams 13, 14 in full line for a cord of minimum diameter (e.g. 3 mm) and in chain lines for a cord of maximum diameter (e.g. 9 mm).

Among the advantages may be mentioned the following:

### 30 Screwless terminals

Insulation stripping of the bundles of conductor strands making up the wire ends is not required.

Cradles into which the wire ends are loaded are colour coded to show live, neutral and earth.

- No tools are needed to wire up the plug if the outer sheath of the cord has been removed to allow separation of the wire ends.

The separated wire ends can be of equal length or can be cut to suit the lay of the wire ends in the plug. Stray strands from wire ends are not possible.

#### Cord grip

- 10 Cord is easily loaded into the cord grip, little force need be used.  
Cannot be wrongly adjusted to the size of cord being used.  
Cannot be wrongly assembled into the plug base.
- 15 Cannot be bypassed, lost or deliberately detached from the plug.  
Grips all sizes of cord symmetrically on the centre line of plug.

#### Lid attachment

- 20 Lid slides onto base and is automatically locked when fully home.  
Lid is locked still further as the plug is placed into socket (Figure 5).  
If lid is not fully home, then the plug will not
- 25 fully enter the socket.  
Lid can be removed without tools when plug is withdrawn from socket, just by pulling plunger and sliding lid off base. (Figures 3, 4 and 5).  
Lid can be removed without tools when plug is
- 30 withdrawn from socket just by sliding button on side of plug to unlock cover and sliding lid off base.  
Lid cannot be removed whilst plug is in socket, since plunger will not allow button to be slid into unlocked position.

CLAIMS

1. A rewirable plug comprising a plug base with a plurality of straight, parallel, electrically-conducting pins projecting from a face of the plug base, the base  
5 coacting with a removable lid to define a plug body and create a volume in which a piercing terminal terminating each respective pin is located, the plug body including an access opening through which a pluri-wire electrical cord enters the said volume and a cord grip adjacent to said  
10 opening to engage said cord and resist its removal from the plug body by cord-applied tension, characterised in that

a) each piercing terminal takes the form of a wire-receiving cradle having a pair of plates turnably connected together via a channel member, said cradle being captive in  
15 a terminal recess and movable therein in the axial direction of the pin between an open condition in which a wire end can be located between the cradle plates and a closed position in which a conducting blade and at least one associated insulation displacement plate are located  
20 between cradle-supported regions of the wire end and pass through said channel member, in that

b) the lid slides on the base in a direction normal to the axes of the pins towards the access opening until interengaging releasable locking means on the lid and base  
25 coact to close the plug body, said locking means being rendered non-releasable when the plug is properly inserted into a socket by means projecting through the face, and in that

c) the cord grip comprises an opposed pair of cams  
30 each turnably mounted in the volume and each linked to an integral spring means, the confronting faces of the cams each exhibiting a series of teeth, the spacing between opposed teeth on the two confronting faces varying as each cam is turned to vary the energy stored in the spring  
35 means.

2. A plug as claimed in claim 1, in which a pair of insulation displacement plates are provided in each piercing terminal, each insulation displacement plate having an edge that confronts a respective opposite side of the  
5 conducting blade in that terminal.

3. A plug as claimed in claim 2, in which each conducting blade is L-shaped, one arm of the L being disposed between respective edges of a pair of arch-shaped insulation displacement plates.

10 4. A plug as claimed in claim 1, in which the conducting blade in each piercing terminal is flanked by the edges of two arch-shaped insulation displacement plates, the span of each arch being less than the width of the blade in that terminal.

15 5. A plug as claimed in claim 1 or claim 2, in which there are three pins, two being current-carrying pins and one an earthing pin, one of the current-carrying pins being linked to its respective piercing terminal by a cartridge fuse carrier.

20 6. A plug as claimed in claim 5, in which the fuse is insertable into its carrier in a direction parallel to the face of the plug base when the lid is removed from the base.

25 7. A plug as claimed in claim 3, in which the insulation displacement plates are formed from a single piece of electrically conducting metal which piece is mounted via feet which sit partly on the floor of the terminal recess and partly on the other arm of the L-shaped blade.

30 8. A plug as claimed in claim 7, in which the span of each arch is less than the width of the blade so that a bundle of conductor strands located inside the electrical insulation of a wire end fed into the piercing terminal

will be split by the blade and clamped at each of two locations, an arch span apart, to the two sides of the blade by a pair of opposing insulation displacement plate edges.

5        9. A plug as claimed in claim 2, 3, 4, 7 or 8, in which each piercing terminal is designed so that a wire fed into the respective cradle will first be pierced by the blade and then clamped by the insulation displacement plates at either side of the blade as the cradle is pressed  
10       down into its terminal recess.

10. A plug as claimed in any preceding claim, in which the non-detachable cradles are colour coded to match the colours of the conductor wire ends to be located therein.

15       11. A plug as claimed in any preceding claim, in which dovetail-shaped projections on the plug base coact with grooves in the lid to provide the sliding engagement of the lid on the base.

20       12. A plug as claimed in any preceding claim, in which the lid automatically locks on the base in the process of being slid into its position to close the plug body.

25       13. A plug as claimed in claim 12, in which a plunger is slidably mounted in the base and is depressed by a ramp on the underside of the lid as the lid moves over the base, whereby when the lid is in its fully closed position, the plunger moves back into its neutral position to lie behind the ramp and lock the lid closed.

30       14. A plug as claimed in claim 13, in which the plunger is sprung in both directions, in and out, by a single lever integral with the plunger, the far end of which lever is held between a fulcrum on the base and a

fulcrum on the lid.

15. A plug as claimed in any one of claims 1 to 13.  
in which the non-releasable mode of the locking means is  
achieved via a plunger which locks the lid on the base when  
5 an outer end of the plunger lies flush with the said face  
of the plug base.

16. A plug as claimed in any preceding claim. in  
which the cord grip allows cords of diameters in the range  
3 to 9 mm to be securely gripped against removal by cord-  
10 applied tension.

17. A rewirable plug substantially as hereinbefore  
described with reference to, and as illustrated in, the  
accompanying drawings.